

Muscle pain - (stiffness)

- capillaries not contractile allow protein blood into muscle cracks.
- water replaces fluid supply of blood.
- heart able to send blood to muscles.
- not dependant on muscle work.

Working muscles

- contains ~~by~~ active hyperemia.
- vessels of visceral organs contract.
- controlled by action + nerves.
- blood is sent to all parts of the body on exercise.

Reverse of blood movement.

- blood goes to part used.
- normal blood count takes a long time.
- training offsets fatigue.

Time of blood recovery depends on

- 1) duration of muscle work + degree of exertion required.
- 2) extent of the state of training.
- 3) condition + development of body.
- fatigue in the blood paralyzed brain centres of muscle activity.

Central fatigue.

- fatigue of motor centres.
- removal of blood.
- occurs suddenly.
- decrease of blood flow + fatigue products.
- helped by change of work of muscle groups.

Peripheral (local) fatigue.

- if muscle movement short, fatigue can be removed.

Fatigued muscle

- irritability lowered.
- stronger effort & will need bc continuity.
- becomes elastic - loses strength.
- finally paralyzed & ceases work.
- fatigue depends on distribution of muscle activity.
- fast muscle work leaves no fatigue.
- slow continuous work is fatiguing.

Static.

- balance between weight & muscle strength.

Dynamic

- quick movements - no balance.

Work - hard work of muscles.

- 1) if work distributed to many large muscles.

- 2) " " is done in rhythmic series of contraction & relaxation.

- measured by power to lift (body) - meter.

General fatigue

- eliminated by skin, kidneys, intestines.
- pulse weak & rapid.
- nerves irritable, tired feeling.
- rise in body temp. & appetite.

Strength exercises

- short duration.
- limited muscle work.
- one or two muscles maximum work.

Speed exercises + endurance

- work is steady rhythmic contraction & relaxation - greater output.

Speed - tires heart & lungs.

Strength - local fatigue of muscle.

Endurance - general " " "

Muscles recover - replace used materials.

- become stronger, fibres thicker.
- new fibres formed.
- increased blood supply & nourishment.
- "activity" - hypertrophy.

- 1) short strong action give power (short)
- 2) frequent use - endurance & strength.

Absolute muscle strength.

- muscle stretched by a too heavy wt.
- equilibrium between wt. & muscle.
- measured by dynamometer.

Thick muscles lose elasticity & length.

- wt. - lifting, wrestling.

Distortion of thorax.

- held high by muscles in contraction.
- high pressure in lungs, diminishes elasticity of lung tissue.

Ideal - long muscles with quick reaction.

- movements must be timed with muscle action.
- training lessens fatigue.
- muscles must be trained for endurance & strength.

Economizing muscle.

- trained muscle - better metabolism.
- yields less wastes.
- rhythmic of contraction & relaxation.
- blood flows regularly through muscle.

● Effects of exercise -

- 1) muscles trained for variety of work.
endurance & speed.
- 2) mobility of body.
- 3) trunk, abdominal & back muscles built up.

Chapter 6.

Training the Nervous System

Each muscle movement requires -

- 1) stimulus from C.N.S.
- 2) conduction of this stimulus through connecting nerve to the muscle.
- 3) reaction of muscle to stimulus.

Nervous system used -

- 1) - exercises of attention & concentration.
- endurance exercises - semi-automatic.
- 2) - exercises of strength & skill. (local)

Nerve - sensori-motor centres - in cortex of cerebrum.
- go to spinal cord - meet motor nerves
there going to muscle.

more all - motor all - nerve plate in muscle.

Motor fibres - brain to muscle.

Sensory - muscle to brain.

- 1) all fibres connect with motor centres of brain
- 2) cross connections between motor & sensory
nerves in brain & spinal cord.

Reflexes produced <

Co-ordination -

- ability to voluntarily select & harmoniously
work together, all muscles for execution of
certain movement.

Assisting motion - action of opposing muscles.
Directing - muscles guarding lateral movement of arm.

Static action - contraction of all muscles.

- 1) Main motor contraction - concentric.
 - 2) Inhibitory (directing) - eccentric.
 - 3) Fixing motion - static.
- balance & energy output.

C.N.S.

Must regulate time & strength of stimuli for each muscle.

Motor centres in brain & S.C. make movement semi-automatic.

Will helps by picturing movement, done by motor areas.

Arm movement - with C.N.S. lacks motor memory impression.

- uses too many muscles & too much energy.

Motor paths trained - by practise of exercises of skill for control of body.

Reaction time

Time between reception of stimuli & execution of movement.

Only some fibres of muscle stimulated.
- depends on work to be done.

Complex - longer reaction time.

Trained by demonstration.

Sudden or - rd.

- 1) Presence of mind.

- 2) Quick reaction to response.

Nervous tension

- sensitive tension of nerve & muscles.

- prolonged conc. strains nervous system.

● Nervous fatigue - affects whole body.

- can be trained
- heart has own automatic nerves.
- will has no control.
- respiratory movements - by will.
- skeletal muscles - semi-automatic.
- fatigue found in motor nerves.

Semi-automatic movements.

- endurance - walking, swimming etc.
- \therefore form should be good.
- nervous work is minimum.
- will eliminated + nervous energy.

Will activity

- in speed + endurance + un rhythmically.

● Time Rest -

- becomes automatic.
- rhythm ~~the~~ reduces fatigue.
- automatic exercises reduce will power + nerve.

Automatic tonicity.

- maintains equilibrium thru continuous contraction + relaxation. "rest tonicity".
- caused by reflex irritation.
- slight tension - quick reaction.
- caused by reflex irritation.
- contraction smooth.
- got by suppling exercises.
- requires big muscle activity.
- automatic.
- difficult in shifting gravity.

State of mind -

- increase heart rate.
- excite nerves + muscles.
- join with activities good.
- will power should develop.
 - overcome physical disinclination.
 - defy danger.
 - suppress sensations.
 - develop character.

Chapter 2.

Lungs + Respiration.

Combustion - heat + energy.

- action of O_2 - heat + waste.
- O_2 - carb - $CO_2 + H_2O$.
- CO_2 - off skin + lungs.

Oxidation - heat for working muscles.
maintains body temp.

Respiration - give off CO_2 from blood.
take on O_2 in lungs.

Inspired air - 79% N_2 21% O_2 .

Expired air - 16% O_2 .
4 1/2% CO_2 8% blood.

- increased during activity.

Adult breathes - 1/2 L. air each breath.
1.5 L. minute.

Increases during activity.

- 1) breathing more rapid.
- 2) depth of breath increased.

"get breath" respiratory movements rest.

Automatic centre - medulla oblongata.

- controlled by nervous system.
- vital centre.
 - stimulated by CO_2 in blood + lack of O_2 .

376 - controlled by vagi nerves.

● Capillaries dilate in muscle & lungs.
- blood flows faster.

Respiratory air - amt. inhaled & exhaled during activity.

Accessory air - more than usual amt. inhaled.

Supplemental air - " " " " inhaled.

Vital capacity - 2 times usual amt. inhaled.
- increased with training.

- 8% blood in lungs with respiration.

Lungs developed by exercise.

- for greater exertion.

- resistance to disease.

- (if not T. B. pleurisy.)

Endurance - resp. increased for a long time.

● Speed - increased suddenly to capacity.

Exercise - strengthens neck, shoulder,

chest muscles & accessory respiratory m.

- fatigue depends on nervous system.

increase of general strength - lung
increase -

Fatigue - only of muscles.
- fatigued, then paralyzed.

Chapter 8.

Heart + Activities.

Heart - automatic.

- increased in work during exercise.
- more exercise - more O_2 needed.
- O_2 demand determines heart activity.
- in rest - half $\frac{1}{2}$ O_2 in blood used.
- heart acts as blood requires more O_2 .
- CO_2 acts as hormone on vagus nerve - goes to C.N.S.

Anemia - heart - increased action to supply O_2 .

Heart - as CO_2 used, heart beats faster.

- 1) Increases no. of contractions
- 2) ~~Force~~ Increases force volume

Heart - 1) well trained muscles.

- 2) fatigue cannot occur - blood supply.
- 3) fatigue avoided - action controlled through nerve centres.

Necessary powers.

- 1) Working muscle receives blood.
 - solid on contraction - helps blood supply by pressing on veins.
- 2) Extension of joints promotes circulation.
 - flexion - pressure on veins. (Venous)
- 3) Respiration - suction in chest expands auricles - which become full of blood.



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